Learning RC5 Control Decoder

build a low-cost remote volume control

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The unit described is intended to be used with any Philips RC5 remote control to enable up/down remote control of a motor driven potentiometer.

A special feature of the design is that it is truly universal in that it can be programmed to respond to any two specific keys on any Philips RC5 compatible remote control.

This is achieved simply by shorting two pins on the unit during power-up. The unit will then indicate PROG mode by flashing the relevant LEDs, and learn the system address and volume UP/DOWN commands as they are pressed on the chosen remote control. The resulting information is stored in non-volatile memory for retention after power-down.

The unit can be reprogrammed at any time in the same way.

A power opamp motor driver is included to directly drive any conventional 5-V motor driven pot.

The PCB is fitted with a 10-way pinheader connector to allow easy design into new or existing equipment. The pins give access to the 3-pin IR sensor, motor wires and the PROG jumper so that these can be sited remotely if required.

Circuit Description

As you can see in **Figure 1**, the circuit is very simple and consists of three sections: an infrared (IR) receiver/demodulator type IS1U60 (IC3), an 8-pin AVR microcontroller AT90S2343 (IC1) and a power opamp

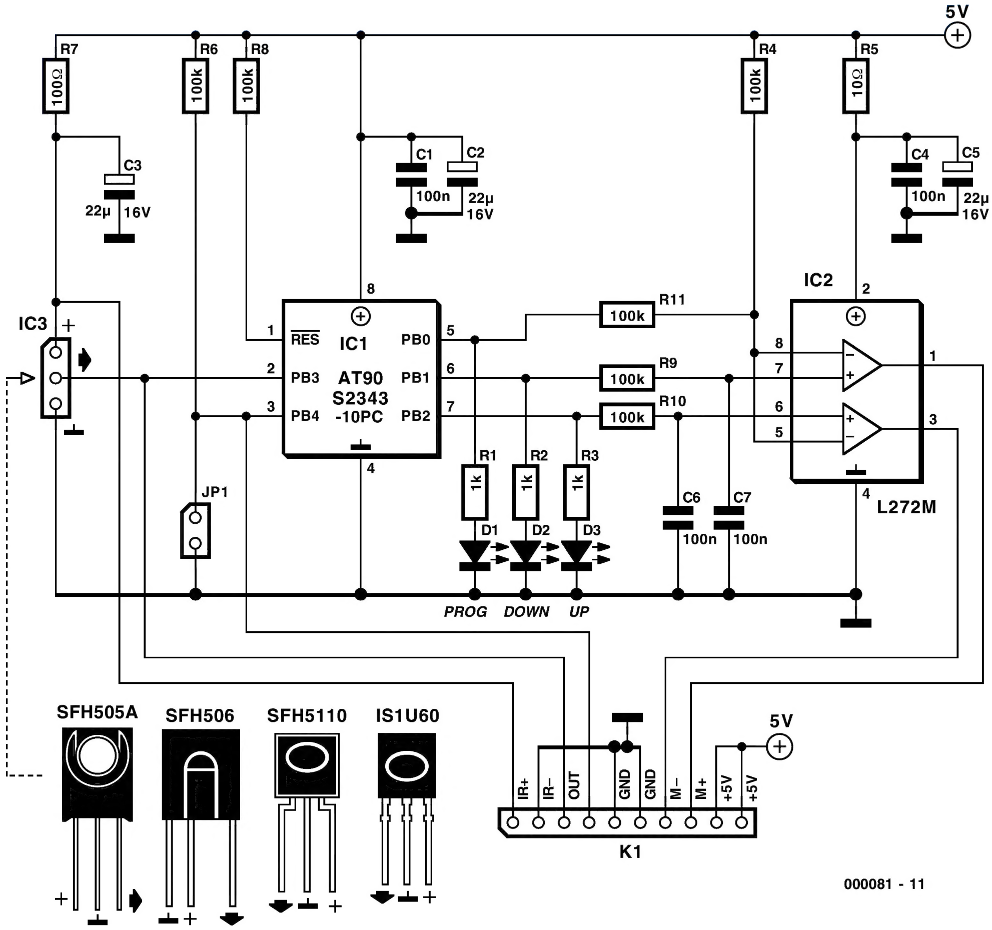

Figure 1. Circuit diagram of the Learning RC5 Decoder. The L272M power opamp drives a 5-V stepper motor.

motor driver L272(IC2).

The IR receiver/demodulator receives the modulated RC5 data stream and provides a demodulated 5-V digital output for processing by the microcontroller. If you can not get hold of the Sharp IS1U60, the Siemens near-equivalents SFH505A, SFH506 or SFH5110 may be used instead. These IR decoders are not pin compatible hence their pinouts are shown in the circuit diagram. Although the SFH505A is now 'obsolete' according to Siemens, you may still manage to get your hands on one.

The microcontroller used is an AVR AT90S2343 8-pin device. This tiny device includes 2k of Flash program memory and 128 bytes of non-volatile EEPROM user memory. An internal oscillator runs at 1 MHz and the efficient design of the processor enables processing approaching 1 MIPs. The microcontroller is available ready-programmed through our Readers Services.

The processor has five I/O pins, all of which are used in the present design:

- PB3 is used as the RC5 data input, active Low.
- PB4 reads the PROG jumper (PROG mode selected when Low).
- PB1 and PB2 are the UP/DOWN outputs to drive the L272 motor driver (the UP/DOWN indicator LEDs are also driven via these pins).
- PB0 doubles as the motor enable output (when Low) and the PROG mode indicator (when High).

The L272 motor driver operates in the following way:

The two –inputs are tied together and connected to a potential divider R4-R11 that sets the voltage of these pins to approx. 2.5 V when the enable output (PB0) is Low. In this mode, taking input pin 7 High and the corresponding input pin 6 Low will drive the separate outputs of the L272M High and Low respectively. Reversing the input pins (6 High, 7 Low) will reverse the outputs hence reversing the direction of the motor.

If the PROG output (PB0) is HIGH the opamp is disabled because the –pins (8 and 5) are pulled to +5 V, making it impossible to turn On either half of the opamp.

The 10-Ω and 100-Ω resistors and the

DIY AT90S Microcontroller

Those of you with access to an AT90S programmer will be pleased to know that the source code (Bascom AVR Basic) and the Hex file for the microcontroller used in this project are available from the Free Downloads section of our website at http://www.elektor-electronics.co.uk. Look for file # **000081-11.exe** under the December 2000 items.

corresponding supply filter capacitors serve to filter out any supply noise present on the 5-V rail.

The quiescent supply current of the unit is negligible and the operating current is determined by the current drawn by the motor used.

Construction

The unit is constructed on a small single-sided PCB as shown in **Figure 2**. IC2 may be either soldered directly or fitted in a DIL socket as preferred, but the microcontroller (IC1) should be fitted in a socket.

If it is intended to use the board as a standalone control, a straight pin header can be fitted in position K1 and the power supply and motor connections made directly to the pins. The IR sensor may be connected with flying wires to enable it to be sited remotely.

If it is intended to incorporate the unit into an existing piece of equipment then the pin header can be plugged into a suitable female connector (socket).

Operation

The unit is extremely easy to set up and operate. On power-up the unit will first check the PROG jumper and if set will enter PROG mode:

PROG mode
The red (PROG) LED will light and the Down LED (D2) will flash to indicate that the Volume Down key on the remote must be pressed. Once the command (and remote control system address) have been correctly received the Down LED will stop flashing and the UP LED with start to flash. The Volume Up key is now pressed on the remote and once correctly received the red PROG LED will go out and the unit will enter NORMAL mode:

NORMAL mode
In this mode the unit continuously monitors the IR sensor and if it detects the programmed volume Up/Down commands will drive the motor (+/–) outputs in the appropriate direction. If the key is held down the motor will continue to turn until it is released.

On power-up (assuming the PROG jumper is not set) the unit will look to see if there is valid data stored in the non-volatile memory for the stored commands. If none is found (i.e. the first time the unit is powered up, or if the data has been lost for some reason) the unit will automatically enter PROG mode as described above.

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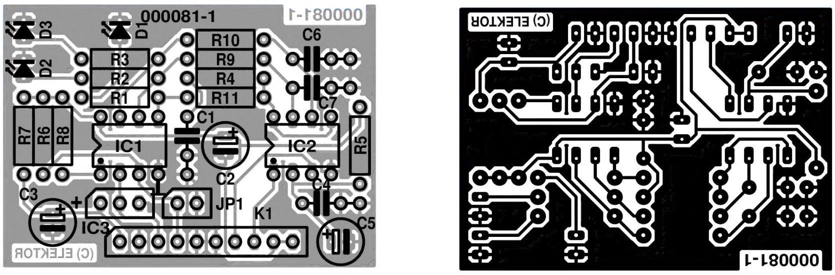

Figure 2. Copper track layout and component mounting plan of the small PCB designed for the control (board available ready-made through Readers Services).

COMPONENTS LIST

Resistors:
R1,R2,R3 = 1kΩ
R4,R6,R8-R11 = 100kΩ
R5 = 10Ω
R7 = 100Ω

Capacitors:
C1,C4,C6,C7 = 100nF
C2,C3,C5 = 22µF 16V radial

Semiconductors:
D1,D2,D3 = low current LED
IC1 = AT90S2343-10PC, Publishers order code: **000081-41**
IC2 = L272M

Miscellaneous:
JP1 = 2-pin pinheader with jumper.
K1 = 10-way SIL pin header for board edge mounting.
IC3 (not on board) 36 kHz centre frequency IR receiver/demodulator, e.g., IS1U60 (Sharp) SFH506-36, SFH5110-36, SFH5110 (Siemens).
PCB, Publishers order code **000081-1**.
Disk, project source code and Hex file, order code 000081-11

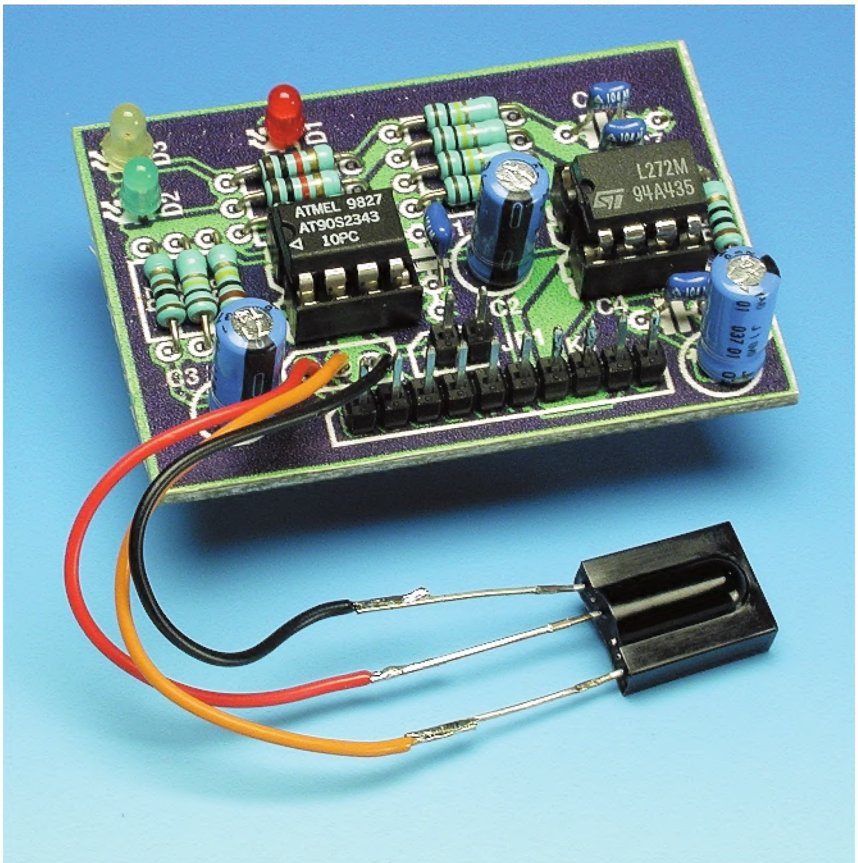

Figure 3. Compare your work against this working prototype of the Learning RC5 Decoder.